SLOPE DETERMINATION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

The present application claims priority from prior provisional application Serial Number 60/432,303, filed 12/09/2002, entitled "A DEVICE FOR MEASURING PITCH OR SLOPE OF A ROOF, SLAB, WALK WAY, PLUMBING LINES, FORMS, OR OTHER SLOPING MEMBERS AS USED IN THE CONSTRUCTION FIELD"; prior provisional application Serial Number 60/447,063, filed 02/13/2003, entitled "SLOPE DETERMINATION SYSTEM"; and prior provisional application Serial Number 60/460,373, filed 04/04/2003, entitled "SLOPE DETERMINATION SYSTEM"; the contents of all of which are incorporated herein by this reference and are not admitted to be prior art with respect to the present invention by the mention in this cross-reference section.

BACKGROUND

This invention relates to providing a hand-held system for improved measurement of slope. More specifically, this invention relates to providing a convenient means for measuring the slope of an element having an irregular surface (such as a shingled roof) or along a surface that is partially obscured by adjacent elements (such as in groups of piping).

It is often necessary, in the field of building and construction, to determine the slope of an existing building element or to establish a slope during the installation of new

construction components. Tradesmen have historically used several techniques to determine the slopes of building elements.

A common technique, such as to establish the slope of a roof, involves placing one end of a bubble-type level on a first point of the roof surface, setting the level to horizontal, measuring out a set horizontal distance from the first point to a second point, followed by taking a vertical measurement from the second point to a lower third point on the roof surface. This type of slope measurement is commonly referred to as determining the "rise over run" of the roof. In the United States, the "rise over run" is typically recorded as a ratio of measured inches of vertical "rise" over twelve inches of horizontal "run". This type of rise over run determination is both time-consuming and cumbersome, requiring at least two separate measuring devices and a number of sequential measuring steps. Further, the operation must be performed on a sloping, typically elevated roof, putting the safety of the tradesman at risk.

A second method of slope determination involves the use of an inclinometer. Inclinometers typically operate using a pivoting pointer that aligns, by gravity, to a fixed scale, and is accurate within one to two degrees. No known prior hand-held inclinometers have been arranged to display more than one indication of slope or to provide multiple simultaneous viewable readings from a single instrument, and are, therefore, of limited

value when attempting to read portions of the inclinometer that are obscured by adjacent building elements (e.g., pipes and/or roof fascia members). Further, no known prior hand-held inclinometers have permitted accurate measurement of slope over an irregular surface, such as a shingled roof surface, without the use of a separate elongated spanning member, such as a rod or board.

To determine zero slope (level) and 90 degree slope (plumb), bubble levels and plumb lines are typically used. No known prior hand-held inclinometers are designed to be used to measure plumb and level.

It would be useful to have a slope measuring system that utilizes a readable scale in multiple positions. It would also be useful to have such a scale that utilizes easier point-marking means, such as a laser-pointer. It would also be useful to have such a scale that is easily replaceable with another scale. It would further be useful to have a slope measuring system that is accurate to one-half of a degree. It would even further be useful to have a slope measuring system that measures plumb and level.

OBJECTS AND FEATURES OF THE INVENTION

A primary object and feature of the present invention is to provide a slope determination system to overcome the above-mentioned problems.

It is a further object and feature of the present invention to provide such a slope determination system that provides multiple, simultaneous, and direct readings of the slope measurement.

It is a further object and feature of the present invention to provide such a slope determination system that displays multiple direct readings of a slope defined by a dimensional rise over a dimensional run.

It is a further object and feature of the present invention to provide such a slope determination system that is substantially unitary in form.

It is a further object and feature of the present invention to provide such a slope determination system that is capable of measuring slope over an irregular surface.

It is a further object and feature of the present invention to provide such a system that is capable of determining slope along a surface that is partially obscured by adjacent elements (such as in groups of piping).

It is a further object and feature of the present invention to provide such a system that is easily gripped by the operator to facilitate ease of use and safety.

It is a further object and feature of the present invention to provide such a system that uses a laser-pointer marking system.

It is a further object and feature of the present invention to provide such a system having scales in any required unit of measure.

It is a further object and feature of the present invention to provide such a system having replaceable scales.

It is a further object and feature of the present invention to provide such a system that is useful to measure plumb and a level.

It is a further object and feature of the present invention to provide such a system that is accurate within one-half of a degree.

A further primary object and feature of the present invention is to provide such a system that is efficient, inexpensive and handy. Other objects and features of this invention will become apparent with reference to the following descriptions.

SUMMARY OF THE INVENTION

In accordance with a preferred embodiment hereof, this invention provides a slope determination system for determining a slope of an element, comprising in combination: calibrated indicia means for providing a calibrated indication of slope; multiple-indicator means for providing at least two simultaneous indications with respect to such calibrated indicia means; gravity-assisted positioner means for maintaining, essentially by

gravity, the position of such multiple-indicator means with respect to vertical; abutting means for abutting the element having the slope to be determined; and geometry-control means for controlling the geometry of such calibrated indicia means relative to such abutting means; wherein, by using such abutting means to abut the element, the slope of the element may be determined by observing at least one of the at least two simultaneous indications of such multiple-indicator means.

In accordance with another preferred embodiment hereof, this invention provides a slope determination system for determining a slope of an element, comprising in combination: calibrated indicia to provide a calibrated indication of slope; at least one multiple-indicator to provide at least two simultaneous indications with respect to such calibrated indicia; at least one gravity-assisted positioner to maintain, essentially by gravity, the position of such at least one multiple-indicator with respect to vertical; at least one abutter structured and arranged to abut the element having the slope to be determined; and at least one geometry-controller to control the geometry of such calibrated indicia relative to such at least one abutter; wherein, by using such at least one abutter to abut the element, the slope of the element may be determined by observing at least one of the at least two simultaneous indications of such at least one multiple-indicator.

Moreover, it provides such a slope determination system, wherein: such calibrated indicia comprises at least one first calibrated scale and at least one second calibrated scale; such at least one first calibrated scale and such at least one second calibrated scale are substantially similar in calibration; and such calibrated indicia is structured and arranged such that such first pointer portion provides such at least one indication with respect to such at least one first calibrated scale, and such second pointer portion provides such at least one simultaneous indication with respect to such at least one second calibrated scale.

Additionally, it provides such a slope determination system, wherein such at least one calibrated scale is between about two and about twelve inches in diameter. Also, it provides such a slope determination system, wherein at least a portion of such at least one first calibrated scale is viewable from a position above such slope determination system. In addition, it provides such a slope determination system, wherein such at least one calibrated scale is printed on at least one rigid frame. And, it provides such a slope determination system, wherein such at least one calibrated scale is printed on at least one replaceable dial. Further, it provides such a slope determination system, wherein such at least one calibrated scale is printed on at least one protective cover. Even further, it provides such a slope

determination system, wherein such at least one calibrated scale is printed on at least one replaceable protective cover.

Moreover, it provides such a slope determination system, wherein such calibrated indicia designates at least one slope defined by at least one rise over at least one run. Additionally, it provides such a slope determination system, wherein such calibrated indicia designates at least one slope defined by at least one distance of rise over a run of twelve-inches. Also, it provides such a slope determination system, wherein such calibrated indicia designates at least one slope having a run of one-eighth-inch and a rise of twelve-inches. In addition, it provides such a slope determination system, wherein such calibrated indicia designates at least one slope defined by angular degrees. And, it provides such a slope determination system, wherein such calibrated indicia designates at least one slope defined by percent of slope.

Further, it provides such a slope determination system, wherein such calibrated indicia further comprises at least one calibrated scale defining at least one position of verticality. Even further, it provides such a slope determination system, wherein such calibrated indicia further comprises at least one calibrated scale defining at least one position of plumb. Moreover, it provides such a slope determination system, wherein such calibrated indicia further comprises at least one calibrated

scale defining at least one position of level.

Additionally, it provides such a slope determination system, wherein: such calibrated indicia comprises at least one first calibrated scale and at least one second calibrated scale; such at least one first calibrated scale and such at least one second calibrated scale are calibrated differently; and such calibrated indicia is structured and arranged such that such first pointer portion provides such at least one indication with respect to such at least one first calibrated scale, and such second pointer portion provides such at least one simultaneous indication with respect to such at least one second calibrated scale.

Also, it provides such a slope determination system, wherein: such at least one substantially rigid frame comprises at least one axle; such at least one multiple-indicator comprises pointer portions comprising first pointer portions and second pointer portions; and such first pointer portions and such second pointer portions are pivotally-mounted to such at least one substantially rigid frame on such at least one axle. In addition, it provides such a slope determination system, wherein: one such first pointer portion and one such second pointer portion are located along a longitudinal axis; and such at least one axle crosses transversely along at least one point along the longitudinal axis. And, it provides such a slope determination system, wherein at least a portion of such at least one first

pointer portion is viewable from a position above such slope determination system.

Further, it provides such a slope determination system, wherein: such at least one gravity-assisted positioner comprises at least one weight having a center of gravity; and such at least one weight is coupled to such multiple-pointer such that the center of gravity of such at least one gravity-assisted positioner is not located on such at least one axle.

Even further, it provides such a slope determination system, wherein such at least one gravity-assisted positioner comprises a rotatable gauge mounted in such at least one substantially rigid frame. Moreover, it provides such a slope determination system, wherein such at least one substantially rigid frame comprises a gauge-brake structured and arranged to hold the position of such rotatable gauge by engaging such gauge-brake and release such rotatable gauge by disengaging such gauge-brake.

Additionally, it provides such a slope determination system, wherein such at least one abutter comprises at least one laser pointer.

Also, it provides such a slope determination system, wherein such at least one geometry controller comprises at least one substantially rigid frame. In addition, it provides such a slope determination system, wherein such at least one abutter comprises at least one essentially flat side of such at least one

substantially rigid frame. And, it provides such a slope determination system, wherein such at least one abutter further comprises a angled rigid metal bar. Further, it provides such a slope determination system, wherein such at least one abutter has a length of about 24 inches. Even further, it provides such a slope determination system, wherein such at least one abutter comprises at least one laser pointer structured and arranged to visually extend at least one longitudinal axis of such at least one abutter.

Moreover, it provides such a slope determination system, wherein such at least one substantially rigid frame further comprises at least one cavity adapted to contain such at least one multiple-indicator and such at least one viewable display of calibrated indicia. Additionally, it provides such a slope determination system, wherein such at least one substantially rigid frame comprises a material selected from the group consisting of: plastic, wood, and metal.

Also, it provides such a slope determination system, further comprising: at least one protective cover for protectively covering such at least one cavity; wherein such at least one protective cover is substantially transparent. In addition, it provides such a slope determination system, wherein such at least one protective cover comprises at least one first calibrated scale and at least one second calibrated scale. And, it provides

such a slope determination system, wherein such at least one protective cover is replaceable by a user. Further, it provides such a slope determination system, wherein such at least one cavity is between about two and about twelve inches in diameter. Even further, it provides such a slope determination system, wherein such at least one substantially rigid frame comprises at least one grip assister adapted to assist a user in gripping such system. Even further, it provides such a slope determination system, wherein: such at least one grip assister comprises at least one aperture through such at least one substantially rigid frame; and such at least one aperture is adapted to pass at least one portion of a hand of the user. Even further, it provides such a slope determination system, wherein such at least one substantially rigid frame is about 24 inches long. Even further, it provides such a slope determination system, wherein such at least one substantially rigid frame is about 36 inches long.

In accordance with another preferred embodiment hereof, this invention provides a slope determination system for determining a slope of an element, comprising in combination: at least one substantially rigid frame; wherein such at least one substantially rigid frame comprises, at least one substantially flat surface adapted to abut the element having the slope to be determined, at least one inclinometer held in fixed relationship with such at least one substantially flat surface, and at least

one grip assister adapted to assist a user in gripping such at least one substantially rigid frame; wherein such at least one grip assister comprises at least one aperture through such at least one substantially rigid frame, and wherein such at least one aperture is adapted to pass at least one portion of a hand of the user.

In accordance with another preferred embodiment hereof, this invention provides an inclinometer calibrated to measure slope comprising at least one representation of at least one roof to indicate that the inclinometer is calibrated for measuring roof slope.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a front-facing elevation view illustrating multiple uses of the slope determination tool of the slope determination system according to a preferred embodiment of the present invention.

FIG. 2 illustrates a close-up view of the indicator gauge of the slope determination tool according to the preferred embodiment of FIG. 1.

FIG. 3 illustrates a front-facing elevation view of the slope determination tool according to a preferred embodiment of the present invention.

FIG. 4 illustrates a side view of the slope determination tool of FIG. 3.

FIG. 5 illustrates a close-up view of the indicator gauge of the slope determination tool of FIG. 2 illustrating a calibrated scale according to a preferred embodiment of the present invention.

FIG. 6 illustrates a sectional view through section 6-6 of FIG. 3.

FIG. 6A illustrates a sectional view through section 6-6 of FIG. 3 illustrating an alternate embodiment of the indicator gauge of FIG. 6.

FIG. 7 illustrates a front-facing view, partially in section, of the slope determination tool and rotatable indicator gauge according to another preferred embodiment of the present invention.

FIG. 8 illustrates a sectional view through section 8-8 of FIG. 7.

FIG. 9 illustrates a front-facing perspective view of the slope determination tool utilizing a laser pointer according to another preferred embodiment of the present invention.

FIG. 10 illustrates a partial sectional detail view, as viewed through the longitudinal centerline of the slope determination tool laser pointer of FIG. 9.

FIG. 11 illustrates a front view of another preferred embodiment of a slope determination tool comprising a top-readable gauge according to another preferred embodiment of the

present invention.

FIG. 12 illustrates a front view of an alternate preferred embodiment illustrating the large top-readable gauge.

FIG. 13 illustrates a side view of the slope determination tool of FIG. 11.

FIG. 14 illustrates a side view of the slope determination tool of FIG. 12.

FIG. 15 illustrates a close-up view of an alternate indicator gauge of the slope determination tool of FIG. 2 illustrating a different calibrated scale according to a preferred embodiment of the present invention.

FIG. 16 illustrates a close-up view of an alternate indicator gauge of the slope determination tool of FIG. 2 illustrating a different calibrated scale according to a preferred embodiment of the present invention.

FIG. 17 illustrates a front-facing elevation view of the slope determination tool according to another preferred embodiment of the present invention.

FIG. 18 illustrates a close-up view of the indicator gauge of the slope determination tool of FIG. 17 illustrating a calibrated scale according to a preferred embodiment of the present invention.

FIG. 19 illustrates a sectional view through section 19-19 of FIG. 17.

FIG. 20 illustrates a close-up view of an alternate indicator gauge of the slope determination tool of FIG. 17 illustrating a different calibrated scale according to a preferred embodiment of the present invention.

FIG. 21 illustrates a close-up view of an alternate indicator gauge of the slope determination tool of FIG. 17 illustrating a different calibrated scale according to a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE BEST MODE
AND PREFERRED EMBODIMENTS OF THE INVENTION

FIG. 1 illustrates a front-facing elevation view illustrating multiple uses of the slope determination tool **100** of the slope determination system **101** according to a preferred embodiment of the present invention. FIG. 1 illustrates two typical examples using the slope determination tool **100** of the slope determination system **101** positioned to take field measurements of the slope of roof **102**, according to a preferred embodiment of the present invention. Preferably, slope determination tool **100** comprises a single linear frame **105** (embodying herein at least one substantially rigid frame) having one essentially flat face **107** along one side, and a circular-shaped indicator gauge **106** adapted to provide two simultaneous readings of a slope, as shown. Preferably, the slope determination tool **100** is fully functional in a three hundred and

sixty degrees range of slope positions, including the upright position **100a**, and inverted position **100b**, as shown. In the first example of FIG. 1, the slope determination tool **100** is depicted resting on the upper surface **108** of roof **102** in upright position **100a**. Roof **102** is shown sheathed with shingles **104** having a tapered cross sectional profile (common in shingles made from wood or stone). The preferred extended length of face **107** permits slope determination tool **100** to simultaneously rest over a number of shingles **104**, thereby preferably permitting slope determination tool **100** to closely conform to the slope of the underlying substrate, as shown.

In the second example of FIG. 1, the improved functionality of slope determination tool **100** is demonstrated by a slope measurement taken along the underside **114** of roof member **112**, while slope determination tool **100** is in inverted position **100b**. Preferably, in most instances, slope determination tool **100** permits the user to observe a reading of slope while indicator gauge **106** is in a partially obscured position, as shown. As illustrated in the second example of FIG. 1, irregular decorative shaping prevents a direct measurement of roof slope to be taken from fascia member **116**. Slope determination tool **100** is shown behind fascia **116** positioned along the underside **114** of an underlying roof member **112**. Although fascia **116** covers and

therefore obscures the upper portion of indicator gauge **106**, a reading of slope is possible using the visible lower portion of indicator gauge **106**, as shown (embodying herein wherein, by using such abutting means to abut the element, the slope of the element may be determined by observing at least one of the at least two simultaneous indications of such multiple-indicator means).

FIG. 2 illustrates a close-up view of the indicator gauge **106** of the slope determination tool **100** according to the preferred embodiment of FIG. 1. Preferably, indicator gauge **106** comprises indicator **120** and one or more calibrated scale(s) **126**, as shown (embodying herein calibrated indicia means for providing a calibrated indication of slope, and further embodying herein calibrated indicia to provide a calibrated indication of slope). Preferably, indicator **120** is pivotally-mounted on indicator gauge **106** at pivot axis **132**, as shown. Preferably, indicator **120** comprises two pointer portions, first pointer portion **122** and second pointer portion **124**, as shown (embodying herein such at least one multiple-indicator comprises pointer portions comprising first pointer portions and second pointer portions).

Preferably, first pointer portion **122** and second pointer portion **124** are arranged in opposing orientation, as shown. As shown in FIG. 2, first pointer portion **122** and second pointer portion **124** preferably share a common longitudinal axis **131**

(embodying herein wherein one such first pointer portion and one such second pointer portion are located along a longitudinal axis). In a preferred embodiment of FIG. 2, pivot axis **132** is preferably located transverse to the longitudinal axis **131**, approximately midway between the tip end(s) **121** of first pointer portion **122** and second pointer portion **124**, as shown (embodying herein wherein such at least one axle crosses transversely along at least one point along the longitudinal axis). Indicator **120** preferably further comprises one or more counterweight portion(s) **134**, preferably arranged off-center of pivot axis **132** such that first pointer portion **122** and second pointer portion **124** remain in an essentially constant vertical position by natural gravity action, as shown (embodying herein gravity-assisted positioner means for maintaining, essentially by gravity, the position of such multiple-indicator means with respect to vertical, and embodying herein at least one gravity-assisted positioner to maintain, essentially by gravity, the position of such at least one multiple-indicator with respect to vertical, and further embodying herein wherein such at least one gravity-assisted positioner comprises at least one weight having a center of gravity; and such at least one weight is coupled to such multiple-pointer such that the center of gravity of such at least one gravity-assisted positioner is not located on such at least one axle). Preferably, counterweight portion **134** comprises an

integral, preferably circular-shaped, enlargement of second pointer portion **124**, as shown. Upon reading the teachings of this specification those of skill in the art will understand that, under appropriate circumstances, such as cost and ease of fabricating, etc., other methods of providing a weight bias to indicator **120**, such as adhered weights, inset weights, using different denser materials, etc., may suffice. Preferably, indicator **120** is constructed of a rigid moldable plastic, as shown. Upon reading this specification, those of skill in the art will understand that under appropriate circumstances, such as durability, cost, user preference, etc., other materials for indicator **120**, such as metal, wood, etc., may suffice. This highly preferred double-pointer configuration permits the pointer portions of indicator **120** to provide two simultaneous readings of slope by observing the alignments of first pointer portion **122** and a second pointer portion **124** relative to the markings **125** of calibrated scale **126**, as shown (embodying herein multiple-indicator means for providing at least two simultaneous indications with respect to such calibrated indicia means, and further embodying herein at least one multiple-indicator to provide at least two simultaneous indications with respect to such calibrated indicia).

Preferably, calibrated scale **126** comprises first scale **128** and an identical second scale **130**, as shown (embodying herein

wherein such calibrated indicia comprises at least one first calibrated scale and at least one second calibrated scale; and such at least one first calibrated scale and such at least one second calibrated scale are substantially similar in calibration). Preferably, first scale **128** and second scale **130** designate a slope defined by a distance of rise (in inches or fraction of inches) over twelve inches of run, as shown. Upon reading this specification those of skill in the art will understand that under appropriate circumstances, such as convenience, preferred application, etc., other calibrated scales and combinations of scales, such as scales in alternate units of measure, etc., may suffice (embodying herein wherein such at least one first calibrated scale and such at least one second calibrated scale are calibrated differently). Preferably, first scale **128** and second scale **130** are located near the outer circumference of indicator gauge **106**, preferably positioned one-hundred eighty degrees apart such that indicator **120**, while in use, provides two simultaneous and identical readings of slope, as shown. In the example of FIG. 2, slope determination tool **100** is again shown resting on the upper surface **108** of roof **102**. First pointer portion **122** is shown aligned with first scale **128** to indicate a slope of five-inches over a twelve-inch run. Similarly, second pointer portion **124** is shown aligned with second scale **130** to provide an identical and simultaneous slope

reading of five-inches of rise over twelve-inches of run. It thus can be appreciated that slope determination tool **100** provides an efficient arrangement for obtaining two identical and simultaneous readings of a single slope, using a single instrument.

FIG. 3 illustrates a front-facing elevation view of the slope determination tool **100** according to a preferred embodiment of the present invention. Preferably, slope determination tool **100** comprises a linear, essentially rectangular frame **105**, preferably having an overall length **A** of about twenty-four inches, and preferably having a height **C** of about two-and-one-half inches, as shown. Preferably, a first side **136** of frame **105** comprises an essentially flat face **107** to permit slope determination tool **100** to be aligned with an element to be measured, as shown (herein embodying abutting means for abutting the element having the slope to be determined, and embodying herein at least one abutter structured and arranged to abut the element having the slope to be determined, and further embodying herein wherein such at least one abutter comprises at least one essentially flat side of such at least one substantially rigid frame). Preferably, frame **105** comprises a second side **138** having a roof-shaped portion **140**, as shown. Roof-shaped portion **140** is preferably adapted to aid the user in distinguishing the function of slope determination tool **100**, as shown (embodying herein an

inclinometer calibrated to measure slope comprising at least one representation of at least one roof to indicate that the inclinometer is calibrated for measuring roof slope). Upon reading this specification those of skill in the art will understand that under appropriate circumstances, such as consumer preference, cultural iconography, etc., other methods of distinguishing the function of slope determination tool **100**, such as pictorial depictions, written indicia, etc., may suffice. In the preferred embodiment of FIG. 3, roof-shaped portion **140** preferably has a width **B** of six-inches and height **J** at peak **142** (as measured from face **107**) of four-and-one-half inches, as shown. Two roof end portions **144** preferably extend distance **H** of three-quarters of an inch from second side **138** to complete the profile, as shown. Each end **146** of frame **105** preferably comprises a one-inch chamfered corner **147**, preferably located opposite face **107**, as shown.

Additionally, frame **105** preferably comprises two gripping apertures **148** adapted to assist a user in gripping frame **105** during transport and use. Preferably, gripping aperture **148** comprises an elongated opening having two circular ends **150**, each circular end **150** having a preferred radius **R1** of five-eighths of an inch, as shown. Preferably, the width **W** of gripping aperture **148** is four inches to accommodate the passage of a human hand, as

shown (embodying herein wherein such at least one substantially rigid frame comprises at least one grip assister adapted to assist a user in gripping such system and wherein; such at least one grip assister comprises at least one aperture through such at least one substantially rigid frame; and such at least one aperture is adapted to pass at least one portion of a hand of the user). Preferably, to assist user comfort during gripping, all perimeter edges **151** are machined to provide a small radius or chamfer, as shown.

Frame **105** preferably further comprises indicator gauge **106**, preferably fixed within frame **105** midway between end(s) **146**, as shown. Preferably, calibrated scale **126** of indicator gauge **106** is calibrated to face **107** such that both are held in a constant geometric relationship by frame **105**, as shown (embodying herein geometry-control means for controlling the geometry of such calibrated indicia means relative to such abutting means, and further embodying herein at least one geometry-controller). Upon reading this specification those of skill in the art will understand that under appropriate circumstances, indicator gauge **106** may be adapted to freely rotate within frame **105** while indicator **120** is held in a constant geometric relationship with face **107**. Frame **105** preferably holds indicator gauge **106** in a constant fixed relationship with face **107**, as shown (embodying herein at least one inclinometer held in fixed relationship with

such at least one substantially flat surface).

FIG. 4 illustrates a side view of the slope determination tool **100** of FIG. 3. Preferably, the slope determination tool **100** comprises a relatively thin, essentially rectilinear profile to facilitate portability and ease of storage, as shown. Preferably, the slope determination tool **100** comprises a constant cross-sectional thickness along its length of about three-quarters-inch, as shown. Further, the rectilinear profile, in combination with the relative flatness of face **107**, preferably permits slope determination tool **100** to be stable and self-supporting in field use, as shown. Upon reading this specification those of skill in the art will understand that under appropriate circumstances, such as materials, cost, preferred use, etc., other profiles, such as square, triangular, etc., may suffice. Preferably, face **107** comprises a continuous rigid metal angle **123** (embodying herein wherein such at least one abutter further comprises a angled rigid metal bar), preferably aluminum, preferably adapted to provide a flat and durable surface along the entire length of face **107**, as shown. Preferably, angle **123** comprises a horizontal leg approximately matching the width of face **107**, as shown. Preferably, angle **123** is mechanically fastened to frame **105** with a vertical leg of angle **123** oriented on the side opposite indicator gauge **106**, as shown. Preferably, to assist user comfort during use, all

perimeter edges **151** are machined to provide a small radius or chamfer, as shown.

Reference is now made to FIG. 5 with continued reference to the above-described figures. FIG. 5 illustrates a close-up view of the indicator gauge **106** of the slope determination tool **100** of FIG. 2 illustrating a calibrated scale **126** according to a preferred embodiment of the present invention. Preferably, calibrated scale **126** comprises two principal scales, a first scale **128** and an essentially identical second scale **130**, as shown. Preferably, first scale **128** and second scale **130** are arcuate in arrangement, having a center radius point at pivot axis **132**, as shown. First scale **128** and second scale **130** are preferably located near the outer circumference **152** of indicator gauge **106** to permit interaction with tip end(s) **121** of indicator **120**, as shown (see FIG. 2). Preferably, the zero line(s) **154** (indicating level) of first scale **128** and second scale **130** are positioned exactly one-hundred-eighty degrees apart and are both perpendicular to face **107**, as shown. Preferably, first scale **128** and second scale **130** designate a slope defined by a distance of rise (in inches or fraction of inches) over twelve-inches of run, as shown. Preferably, both first scale **128** and second scale **130** provide readings of up to at least forty-inches of rise per foot of run on each side of zero line **154**, as shown. Upon reading

this specification those of skill in the art will understand that under appropriate circumstances, such as cost, intended use, intended user, etc., other scale ranges, such as continuous scales, scales having lesser ranges, scales having greater ranges, alternate dimensional formats, etc., may suffice.

Preferably, calibrated scale **126** comprises two secondary scales, preferably third scale **156** and an essentially-identical fourth scale **158**, as shown. Preferably, the zero line(s) **160** (embodying herein wherein such calibrated indicia further comprises at least one calibrated scale defining at least one position of verticality) of third scale **156** and fourth scale **158** are positioned exactly one-hundred-eighty degrees apart and are both parallel to face **107**, as shown. Third scale **156** and fourth scale **158** preferably provide readings of one-eighth inch of run per twelve-inches of rise on each side of zero line(s) **160**, as shown. Upon reading this specification those of skill in the art will understand that under appropriate circumstances, considering such issues as cost and intended use, calibrated scale **126** may be rotatable to bring zero line(s) **160** perpendicular with face **107**, thereby permitting third scale **156** and fourth scale **158** to determine a slope of one-eighth inch of rise per twelve-inches of run.

Calibrated scale **126** preferably includes identifying and explanatory indicia to assist the user in operating slope

determination tool **100**, as shown. For example, calibrated scale **126** preferably includes slope/pitch marking **162** to assist the user in identifying the function of slope determination tool **100**, as shown.

Preferably, calibrated scale **126** is a dial made from rigid printable plastic. Upon reading this specification those of skill in the art will understand that under appropriate circumstances, such as cost, durability, etc., other materials, such as metal, wood, laminate, paper, etc., may suffice for calibrated scale **126**. Preferably, markings **125** are printed on the surface of calibrated scale **126** using a silk-screen process, as shown. Upon reading this specification those of skill in the art will understand that under appropriate circumstances, such as cost, durability, intended use, etc., other methods of marking calibrated scale **126**, such as etching, integral-raised molding, printing, etc., may suffice.

FIG. 6 illustrates a sectional view through section 6-6 of FIG. 3. FIG. 6 illustrates the preferred features of a preferred indicator gauge **106**. Preferably, indicator gauge **106** comprises a circular cavity **164**, preferably recessed into frame **105**, as shown (embodying herein wherein such at least one substantially rigid frame further comprises at least one cavity adapted to contain such at least one multiple-indicator and such at least one viewable display of calibrated indicia). Preferably, calibrated

scale **126** is firmly attached to the back portion **166** of cavity **164**, preferably by bonding, as shown. Under appropriate circumstances, calibrated scale **126** may be printed, etched, or molded directly onto back portion **166** of cavity **164**. Preferably, indicator **120** is pivotally mounted to frame **105** using axle **168** located at pivot axis **132**, as shown. Preferably, axle **168** comprises a metal pin, as shown. Preferably, axle **168** passes through indicator **120** and calibrated scale **126** and is firmly retained on frame **105**, as shown (embodying herein wherein such at least one substantially rigid frame comprises at least one axle, and further embodying herein wherein such first pointer portions and such second pointer portions are pivotally-mounted to such at least one substantially rigid frame on such at least one axle). An integral spacer **170** preferably engages over axle **168**, as shown, to position indicator **120** away from calibrated scale **126**, to prevent, for example, accidental frictional contact between indicator **120** and calibrated scale **126**. Upon reading this specification those of skill in the art will understand that under appropriate circumstances, such as cost, ease of manufacturing, etc., other methods of suspending indicator **120** within indicator gauge **106**, such as an axle formed integrally with calibrated scale **126**, etc., may suffice.

Preferably, a fixed cover **172**, preferably transparent,

preferably constructed of glass, most preferably constructed of plastic, protects cavity **164**, as shown (embodying herein at least one protective cover for protectively covering such at least one cavity; wherein such at least one protective cover is substantially transparent). Cover **172** is preferably recessed into frame **105** to maintain a flush finish on the exterior of slope determination tool **100**, as shown. Preferably, cover **172** is permanently sealed to frame **105**. More preferably, cover **172** is removable to permit replacement of indicator **120**, cover **172**, and/or calibrated scale **126**, as shown.

Preferably, frame **105** is made from a rigid and durable material, such as plastic, wood, steel or aluminum. Most preferably, frame **105** is made from moldable plastic, as shown. Upon reading this specification those of skill in the art will understand that under appropriate circumstances, such as cost, intended use, etc., other materials, such as carbon, fiber, mixed combinations of the above-mentioned materials, etc., may suffice.

FIG. 6A illustrates a sectional view through section 6-6 of FIG. 3 illustrating another embodiment **165** of the indicator gauge **106** of FIG. 6. In embodiment **165**, axle **168** is preferably held in place at longitudinal axle ends **167** and **169**, wherein longitudinal axle end **167** is firmly attached to frame **105** and longitudinal axle end **169** is firmly attached to cover **172**, which is preferably

transparent, as shown. Preferably, integral spacer **171** engages over axle **168** to position indicator **120** away from the calibrated scale **126** to assist in free movement of the indicator **120** and deter binding between the indicator **120** and calibrated scale **126**, as shown. Other than as herein described for the alternate embodiment **165** of FIG. 6A, the other major components of such embodiment **165** are preferably as described above in FIG. 6.

Upon reading this specification those of skill in the art will understand that under appropriate circumstances, such as economics, preferred materials, intended use, etc., other methods of allowing free movement of the indicator **120**, such as bearings, magnets, etc., may suffice.

FIG. 7 illustrates a front-facing view, partially in section of the slope determination tool **100** with a rotatable indicator gauge **178** (embodying herein at least one gravity-assisted positioner comprises a rotatable gauge mounted in such at least one substantially rigid frame) according to another preferred embodiment **173** of the present invention. Preferably, in embodiment **173**, the slope determination tool **100** comprises a rotatable indicator gauge **178**, as shown. Preferably, the rotatable indicator gauge **178** comprises an internal disc **181** that freely rotates about the fixed axle **168** of the indicator gauge **178**, as shown, as did the indicator **120** rotating about the axle

168 as in the previously described gauge **106** above. Preferably, the internal disc **181** comprises a weighted bottom portion **183**, preferably heavier than the top portion **185** and arranged such that the internal disc **181** will always indicate a horizontal plane (zero degrees slope) when the indicator gauge **178** is in a perpendicular position (vertical) to the slope determination tool **100** and the slope determination tool **100** is on a flat and horizontally level plane (no slope), as shown.

Preferably, cover **172** comprises a fixed mark **180** indicating a resting point for the indicator gauge **178** such that when a slope is horizontal the internal disc **181** reading on the calibrated indicia **126** is zero degrees, as shown. Upon reading this specification those of skill in the art will understand that under appropriate circumstances, such as cost, readability, intended use, etc., other ways of applying fixed mark **180**, such as engraving, painting, etching, etc., may suffice. Most preferably, the fixed mark **180** is permanently etched and colored on cover **172**, as shown.

Preferably, in embodiment **173**, the slope determination tool **100** further comprises a gauge brake **174** that will hold the internal disc **181** such that, when the gauge brake **174** is engaged, the internal disc **181** will not move from the position it was in when the gauge brake **174** was engaged, as shown (embodying herein

wherein such at least one substantially rigid frame comprises a gauge-brake structured and arranged to hold the position of such rotatable gauge by engaging such gauge-brake and release such rotatable gauge by disengaging such gauge-brake). Preferably, the gauge brake **174** assists in determining slope with the slope determination tool **100** when, for example, slope determination tool **100** has to be raised overhead and used when the rotatable indicator gauge **178** cannot be seen. In such usage, the user can set the slope determination tool **100** on the slope and apply the gauge brake **174** until the user can lower the slope determination tool **100** and read the indicator gauge **178**. Upon reading this specification those of skill in the art will understand that under appropriate circumstances, such as location of the slope to be determined, visual obstacles blocking the users view of the indicator gauge **178**, etc., other types of use, such as from a position under a slope, over a slope, etc., may suffice.

FIG. 8 illustrates a sectional view through section 8-8 of FIG. 7. FIG. 8 further illustrates the embodiment **173** combining the rotatable indicator gauge **178** and gauge brake **174**.

Preferably, gauge brake **174** comprises a simple push-button shaft **175** with a return spring **176** and brake-pad assembly **186**, as shown. Preferably, an upper portion **187** of the frame **105** comprises an aperture **177**, preferably slightly larger than the

diameter of the shaft **175** that creates an opening through the upper portion **187** to the indicator gauge **178** through which the push-button shaft **175** may be installed, as shown. Preferably, the aperture **177** further comprises a recessed inner end **195**, preferably recessed such that the brake-pad tip will sit flush into the recessed inner end **195** when in a resting state (not depressed), as shown. Preferably, the push-button shaft **175** comprises a metal shaft, preferably having an upper flared flat-button-end **179** and a lower hollow inner-threaded tip, as shown. Preferably, the brake-pad assembly **186** comprises a flared flat-bottom end **197** having an external threaded screw portion **184** that threads into the lower hollow inner-threaded tip of the push-button shaft **175**, as shown. Preferably, a brake-pad **199** is attached to the flared flat-bottom end **197**, as shown.

The described gauge brake **174** assembly assists in installing the gauge brake **174** as the shaft may be placed through spring **176** and into aperture **177**, after which the brake-pad assembly **186** may be threaded onto the shaft **175**, as shown. In such manner the gauge brake **174** will not fall out of the aperture **177** and the spring will provide enough room for the brake-pad **199** to move onto the indicator gauge **178** when depressed and to return into the recessed inner end **195** when in a resting state (not depressed). Upon reading this specification those of skill in

the art will understand that under appropriate circumstances, such as economics, ease of manufacturing, etc., other methods of manufacturing and assembling the brake-pad assembly **186**, such as unitary forming of parts, adhesive attaching, other styles of push-buttons, etc., may suffice.

Upon reading this specification those of skill in the art will understand that under appropriate circumstances, such as cost, manufacturing efficiency, accommodation for left-handedness, ease of use, etc., other arrangements of gauge brake **174**, such as different shapes, styles, sizes, placements and/or different materials, such as high-density plastics, carbon-fiber, wood, metals, etc., may suffice.

FIG. 9 illustrates a front-facing perspective view of the slope determination tool **100** utilizing a laser pointer **190** (embodying herein wherein such at least one abutter comprises at least one laser pointer) according to another preferred embodiment **210** of the present invention. Preferably, laser pointer **190** provides a visual indicator to assist a user in determining a slope at a distant point, as shown. For example, when given at least two points **189** (such as might be found if used on a building slab/foundation herein illustrated as axis **X**) and point **192** (such as may be located along a vertical wall herein illustrated as axis **Y**), the slope determination tool **100** preferably utilizes laser pointer **190** to determine the slope

between the two points **189** and **192**, as shown. Preferably, this is accomplished by placing one end **212** of the flat planar "level" portion **214** of the slope determination tool **100** on point **189** (axis **X**) and then aiming the laser pointer **190** at the other point **192** (along axis **Y**), such that a user can then read the subsequent slope on the indicator gauge **106**, as shown.

Furthermore, when given at least one end-point and a desired slope, the slope determination tool **100** utilizing laser pointer **190** may be used to determine a second end-point given the slope, as shown. Preferably, by placing one end **212** of the flat planar "level" portion **214** of the slope determination tool **100** on point **189** and then adjusting the angle **α** until the indicator gauge **106** indicates the desired slope, the laser pointer **190** may be activated and will be pointing at the point **192** to illustrate where the point **192** would be with that slope, as shown.

Preferably, laser pointer **190** is mounted onto frame **105** near one gripping aperture **148** such that actuator button **191** can be easily depressed by a user's finger **194**, as shown. Preferably, when actuated, laser pointer **190** will emit laser beam **193** that is parallel to and aligned with the flat planar "level" portion **214** of first side **136**, thereby marking a precise point **192** on axis **Y**, as shown (embodying herein wherein such at least one essentially flat side of such at least one substantially rigid frame

comprises at least one laser pointer structured and arranged to visually extend at least one longitudinal axis of such at least one essentially flat side). Preferably, laser pointer **190** is removable and/or serviceable. Upon reading this specification those of skill in the art will understand that under appropriate circumstances, such as cost, manufacturing efficiency, accommodation for left-handedness, ease of use, etc., other arrangements of laser pointer **190**, such as different shapes, styles, sizes, placements, etc., may suffice.

FIG. 10 illustrates a partial sectional detail view as viewed through the longitudinal centerline of the slope determination tool laser pointer of FIG. 9. Preferably, the laser pointer **190** is secured to frame **105** by setscrews **196** as shown, allowing the laser **198** to be adjusted or removed, for example, to replace the entire unit or batteries. Upon reading this specification those of skill in the art will understand that under appropriate circumstances, such as cost, manufacturing efficiency, accommodation for commonly available lasers **198**, ease of use, etc., other arrangements of laser pointer **190**, such as different shapes, styles, sizes, ways of securing, placements, etc., may suffice. Preferably, laser beam **193** is parallel to, and aligned with, the flat planar "level" portion **214**, as shown. Preferably, a finger-actuator button **191** controls laser **198** such that, when actuator button **191** is depressed, a laser beam **193** is

emitted from laser **198**, as shown. Upon reading this specification those of skill in the art will understand that under appropriate circumstances, such as cost, manufacturing efficiency, accommodation for left-handedness, ease of use, etc., other control arrangements of actuator button **191** such as different shapes, styles, sizes, placements, etc., may suffice.

FIG. 11 illustrates a front view of another preferred embodiment of a slope determination tool **222** comprising a top-readable gauge **224** according to another preferred embodiment of the present invention. FIG. 13 illustrates a side view of the slope determination tool **222** of FIG. 11. Preferably, slope determination tool **244** utilizes a frame **226** that holds top-readable gauge **224**, as shown. Top-view is understood to mean that a user looking downward onto the slope determination tool **222** can read the calibrated scale **230**. Most preferably, top-view is further understood to mean that any portion of the entire viewable peripheral arc **200** of top-readable gauge **224** may be read (embodying herein wherein at least one of such first pointer portion is viewable from a position above such calibrated indicia), preferably, approximately one-hundred-eighty degrees being viewable by a user. Upon reading this specification those of skill in the art will understand that under appropriate circumstances, such as cost, manufacturing efficiency, accommodation for left-handedness, ease of use, etc., other top

view arrangements, such as different shapes, styles, sizes, materials, etc., may suffice. Preferably, any portion of markings **232** along the viewable arc **200** is viewable by a user through cover **171**, as shown.

Preferably, the top-readable gauge **224** further comprises dual pointers **234** that extend over the calibrated scale **230**, as shown. Preferably, the pointers **234** are comprised of 24-gauge or smaller metal wire and are shaped to wrap around the calibrated scale **230**, so that at least a portion of indicator **120** is also top-readable, as shown. Upon reading this specification those of skill in the art will understand that under appropriate circumstances, such as cost, manufacturing efficiency, ease of use, etc., other arrangements of pointer **234**, such as different shapes, styles, sizes, materials, etc., may suffice.

FIG. 12 illustrates a front view of an alternate preferred embodiment illustrating a large top-readable gauge **242**. FIG. 14 is a side view of the slope determination tool **244** of FIG. 12. Preferably, slope determination tool **244** comprises a very large top-readable gauge **242**, preferably comprising more increments of measure, greater accuracy, and larger markings **246** than slope determination tool **222** to allow for more precise determinations of slope, as shown. Upon reading this specification those of skill in the art will understand that under appropriate

circumstances, such as cost, manufacturing efficiency, ease of use, etc., other arrangements of large gauge **242**, such as different shapes, styles, sizes, markings **125**, etc., may suffice.

It is noted that the slope determination tool **244** comprises similarities to slope determination tool **222** in that both embodiments comprise a top-readable gauge and may be used to determine slope, as shown.

FIG. 15 illustrates a close-up view of an alternate calibrated scale **850** for the slope determination tool of FIG. 2. Preferably, calibrated scale **850** indicates slope in degrees on outer scale **851**, and rise (in inches) over 12 inches of run on inner scale **852**, as shown. Preferably, calibrated scale **850** is printed, etched, or molded onto indicator gauge **106** or cover **172**, as shown. Preferably, calibrated scale **850** is removable and replaceable.

FIG. 16 illustrates a close-up view of an alternate calibrated scale **860** for the slope determination tool of FIG. 2. Preferably, calibrated scale **860** indicates slope in degrees on outer scale **861**, and ratio of rise to run on inner scale **862**, and percent of slope on inset scale **863**. Preferably, calibrated scale **860** is printed, etched, or molded onto indicator gauge **106** or cover **172**, as shown. Preferably, calibrated scale **860** is removable and replaceable.

FIG. 17 illustrates a front-facing elevation view of the slope determination tool according to another preferred embodiment of the present invention. Preferably, slope determination tool **870** comprises a linear, essentially rectangular frame **705**, preferably having an overall length **A** of at least about thirty-six inches, and preferably having a height **C** of at least about eight-and-one-half inches, as shown. Preferably, frame **705** is metal, preferably aluminum, as shown. By increasing the size of at least one of the radius of circular cavity **874**, the radius of calibrated scale **871**, and the overall length **A**, greater accuracy is achieved, as shown. The inventor has determined that when calibrated scale **871** is preferably at least about eight inches in diameter and length **A** is preferably at least about 36 inches, an accuracy of at least one half of one degree is achieved, as shown. This high degree of accuracy is especially useful to professional contractors and building inspectors. Preferably, this high degree of accuracy permits slope determination tool **870** to be used as a plumb line and as a level, as shown. Other than as herein described for the alternate embodiment **870** of FIG. 17, the other major components of such embodiment **870** are preferably as described above in FIG. 6.

FIG. 18 illustrates a close-up view of the indicator gauge of the slope determination tool **870** of FIG. 17 illustrating a

calibrated scale **871** according to a preferred embodiment of the present invention. Calibrated scale **871** preferably indicates slope in degrees on inner scale **881**, rise over twelve-inches of run on outer scale **882**, plumb on inset scale **883**, and level on inset scale **884**, as shown. Preferably, calibrated scale **871** may be printed, etched, or molded onto indicator gauge **106** or, most preferably, onto cover **172**, as shown. Preferably, calibrated scale **871** is removable and replaceable, as shown. Cover **172**, preferably having calibrated scale **871**, is preferably attached to frame **705** with set-screws **885**, as shown. Cover **172** is preferably properly aligned with frame **705** by alignment grooves **886** and set-screws **885**, as shown. Cover **172**, having calibrated scale **871**, is preferably easily removed and replaced by removing and replacing set-screws **885**. Upon reading this specification those of ordinary skill in the art will understand that under appropriate circumstances, such as cost, ease of manufacturing, etc., other means of accurately aligning and securing cover **172**, such as clips, friction, screw-on covers, etc., may suffice.

FIG. 19 illustrates a sectional view through section 19-19 of FIG. 17. FIG. 17 details how set-screws **885** preferably attach cover **172**, preferably having calibrated scale **871**, to frame **705**, as shown.

FIG. 20 illustrates a close-up view of an alternate

indicator gauge of the slope determination tool of FIG. 17 illustrating a different calibrated scale **1200** according to a preferred embodiment of the present invention. Calibrated scale **1200**, which is preferably sized to fit the eight-inch cover **172** of embodiment **870**, preferably indicates slope in degrees on outer scale **1201**, plumb on inset scale **1203**, and level on inset scale **1204**, as shown. Calibrated scale **1200** is preferably printed, etched, or molded onto indicator gauge **106**, or, most preferably, replaceable cover **172**, as shown.

FIG. 21 illustrates a close-up view of an alternate indicator gauge of the slope determination tool of FIG. 17 illustrating a different calibrated scale **1210** according to a preferred embodiment of the present invention. Calibrated scale **1210**, which is preferably sized to fit the eight-inch cover **172** of embodiment **870**, preferably indicates slope in degrees on inner scale **1211**, percent of slope on outside scale **1212**, plumb on inset scale **1213**, and level on inset scale **1214**, as shown. Calibrated scale **1210** is preferably printed, etched, or molded onto indicator gauge **106**, or, most preferably, replaceable cover **172**, as shown.

Under appropriate circumstances, an assortment of replaceable covers **172** with various calibrated scales **106** may be available to users.

Upon reading this specification those of skill in the art will understand that under appropriate circumstances, such as intended use, local units of measure, user preference, etc., other calibrated scales, having other combinations and types of scales, may suffice.

Although applicant has described applicant's preferred embodiments of this invention, it will be understood that the broadest scope of this invention includes such modifications as diverse shapes and sizes and materials. Such scope is limited only by the below claims as read in connection with the above specification.

Further, many other advantages of applicant's invention will be apparent to those skilled in the art from the above descriptions and the below claims.